synchronize but the second arriving mobile terminal will not be able to synchronize.

One example of destructive collision is taught by U.S. Pat. No. 5,394,391 (Chen) and U.S. Pat. No. 5,257,257 (Chen2), both of which disclose a method of controlling the operation of a packet switched CDMA telecommunication network. Both patents teach that the transmitting terminal begins its transmission routine by sensing whether or not the receiving terminal is busy. If the receiving terminal is free, the transmitting terminal initiates its transmission. However, because this sensing for activity is performed randomly, and accordingly so is the subsequent transmission, if a second mobile terminal begins transmitting at the same time, a destructive collision will most likely occur.

One method to reduce the probability of destructive collisions is taught by U.S. Pat. No. 5,295,152 (Gudmundson et al.). Although Gudmundson et al. teaches increasing the capacity of radiotelephone communication systems by eliminating interference to communication traffic caused by random access bursts from unconnected mobile stations, it does so by interrupting the communication traffic of other mobile stations using the same frequency at periodic intervals. Consequently, it does not allow multiple mobile transmitters to transmit in an orderly fashion.

Another method to reduce the probability of destructive collisions functions by delaying the synchronization message according to some probabilistic rule. However, the initial delay tends to propagate additional synchronization acquisition delays. Also, for mobile terminals operating with relative delays from the base station of more than a chip duration, the collision of the numerous synchronization messages will also result in added interference. These secondary interferences are referred to as interfering collisions.

One additional shortcoming of CDMA systems in general, and ADTX-MAC schemes in particular that must be resolved is that, because all the mobile terminals would use the same uplink channel, their synchronization message must include a field identifying each individual transmitting mobile terminal. Because the base station must then decode the identification field contained in the synchronization message before sending an acknowledgment to the sending mobile terminal, there are certain repercussions on performance. For example, the performance of the uplink is quite sensitive to the closed-loop power control. Since closed-loop power control is typically not established by the time the synchronization message is transmitted, the error rate in decoding the identification part of the synchronization message may be quite high. Consequently, the length of the synchronization message must be long enough to ensure that the mobile terminal's identification field is correctly decoded by the base station.

As evidenced by the above discussion, there are several interrelated shortcomings associated with the ADTX-MAC scheme. For example, the ADTX-MAC's performance depends on the number of synchronization-reservation channels required to establish uplinks for all the mobile terminals. In turn, the number of synchronization-reservation channels required depends significantly on the synchronization message traffic generated by the mobile terminals. Because the number of synchronization messages generated per unit of time by a given source is difficult to characterize, the ADTX-MAC scheme is inherently unstable due to the potential for destructive or interfering collisions. As a result of this uncertainty in the amount of synchronization traffic generated, not only is the system designer forced to underdimension the system as a whole, the design of the protocol needed to stabilize the system also becomes more complicated.

In light of the foregoing, there is a need for a method or apparatus that can make more efficient use of uplink channels by sharing the uplink channels between several mobile terminals engaged in bursty data transmission.

SUMMARY OF INVENTION

Accordingly, the present invention is directed to a method and apparatus to acquire synchronization by a base station with a mobile terminal at the beginning of the on-period on the uplink channel which substantially overcomes one or more of the above mentioned problems arising from limitations and disadvantages of the related art.

To achieve these and other advantages and in accordance with the purpose of the invention, as embodied and broadly described, the invention is a method and apparatus for transmitting a synchronization message on an uplink channel which not only reduces the number of receivers on the base station but also avoids the need for identifying the mobile terminal transmitting the synchronization message, which as a consequence avoids collisions among other mobile terminals in the same cell and reduces interference.

It is to be understood that both the foregoing general description and the following descriptions are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

The accompanying drawings are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate one of many embodiments of the invention and together with the description serve to explain the principles of the invention.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a schematic representation of the establishment of a synchronous synchronization-reservation channel.

FIG. **2** is a schematic representation of a call initiation algorithm.

FIG. **3** is a schematic representation of a call termination algorithm.

FIG. **4** is a schematic representation of the format of the synchronization-reservation channel on the reverse link.

FIG. **5** is a schematic representation of the format of the reservation response channel on the forward link.

DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made in detail to the present preferred embodiment of the invention, an example of which is illustrated in the accompanying drawings. This embodiment is a synchronous approach to the transmission of a synchronization message in order to overcome the shortcomings of the ADTX-MAC scheme described above. The preferred embodiment is synchronous discontinuous transmission MAC (SDTX-MAC)scheme in which a TDMA frame on a synchronous synchronization-reservation (SSR) channel on the reverse link is divided into short time slots, and each time slot is assigned to a mobile terminal.

The first step in establishing a SDTX-MAC scheme is depicted in FIG. **1**. In such a depiction which, for example can be applied to a mobile telephone system, the base station maintains constant contact with its assigned mobile terminals by constantly broadcasting, as shown in step **101**, a pilot signal on the downlink pilot channel. The user initiates, as shown in step **103**, a transmission from the mobile terminal to the base station by powering on the mobile terminal. Once